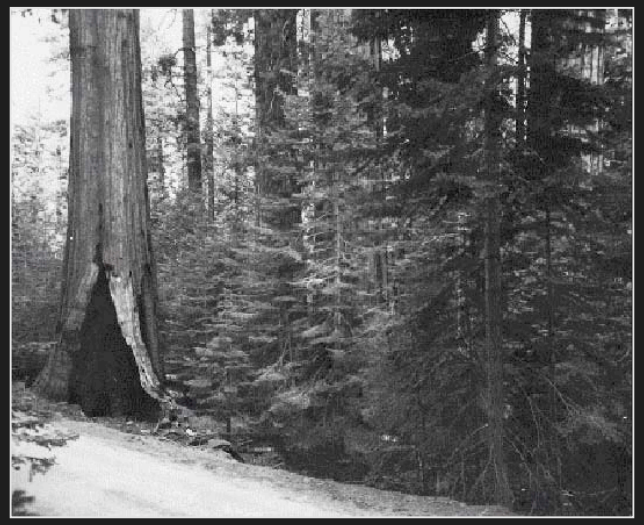
THE TEAKETTLE EXPERIMENT:

Brief Overview & Summary

Introduction

Mariposa Grove, 1890s



Same location, 1970s

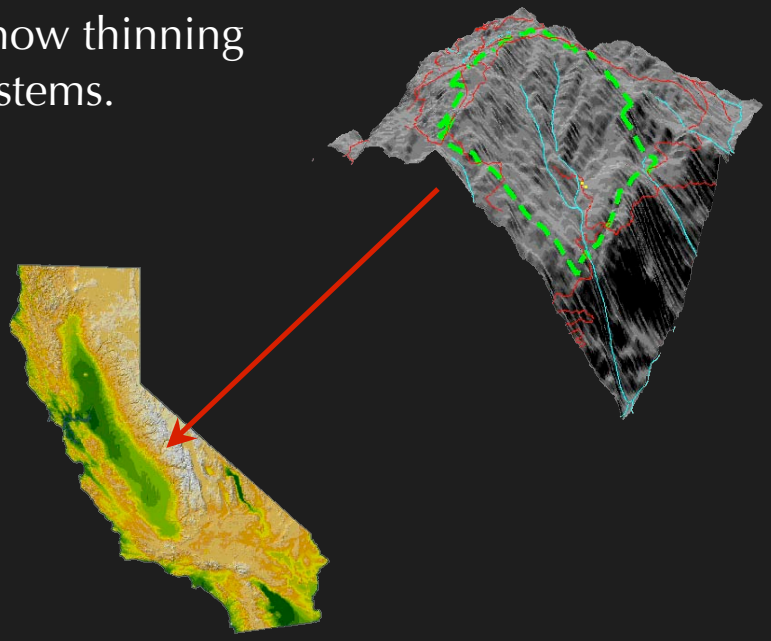
Like much of the western United States, Sierra Nevada forests have been significantly changed by a century of fire suppression. Historically, the fire return interval was 12-15 years and is now estimated to be > 600 years.

- Prescribed fire and mechanical thinning are widely used for restoring forest health, but how do their ecological effects differ?
- The Teakettle Experiment was initiated in response to this question.
- The experiment is an interdisciplinary collaboration of more than a dozen scientists, working in coordination, to investigate the effects of fire and thinning treatments.

Experimental Design:

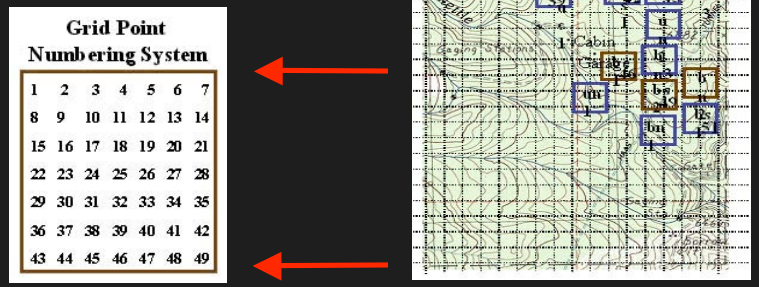
The Teakettle Experiment was designed to examine how thinning and fire differ in their effects on mixed-conifer ecosystems.

	NO BURN	BURN
NO THIN	Control	Burn only
UNDERSTORY THIN *(10"< trees <30")*	Thin only	Burn & thin
OVERSTORY THIN "SHELTERWOOD" *(all trees > 10", except 22/ha)*	Thin only	Burn & thin



There are a total of 18 experimental plots (6 treatment types x 3 replicates of each type). Each plot is 10 acres (4 ha) in size.

Within each plot, all data is collected at the same sample points so that connections between different studies and across ecological disciplines can be made.



Component Studies

Climbing a 60 meter red fir to study lichens

The core experiment was designed to run from 1998 through the burning and thinning treatments in 2000 and 2001 till 2004.

Data was collected for the following ecological component studies:

Canopy Invertebrates
Decomposition
Fire History
Flying Squirrels & Truffles
Global Climate Change
Lichen Growth & Dispersal
Microclimate
Mycorrhizal Diversity
Nitrogen Dynamics
Seed Dispersal
Soil & Coarse Wood Debris Invertebrates
Soil Moisture
Soil Nutrients
Soil Respiration
Tree Pest & Pathogens
Tree Regeneration
Tree/Shrub Mortality & Growth
Understory Herb & Shrub Diversity
Water Movement using Stable Isotopes

Key Results

1) **What are the primarily influences on ecosystem function in mixed-conifer forests?**

   Water: largely determined by snowpack depth, soil depth and % organic matter. Temperature is also a strong, but secondary, influence. Soil nitrogen has little effect.

2) **In the absence of fire what drives tree regeneration and mortality?**

   Canopy cover, climate and pests. Regeneration is influenced by overstory canopy cover *(> 50%)* and wet El Niño years *(important for pine and red fir)*. Mortality is driven by drought and pests. Water stress is produced by dense stand conditions from fire suppression and periodic La Niña events. This drought stress predisposes trees, and pest/pathogens *(particularly beetles)* are the final agent.

3) **What are some of the key functions of large trees and pieces of coarse woody debris?**

   Large logs may provide runway cover for small mammals, but do not have the same functional importance *(i.e., moisture reservoirs, nutrient sources, or seedling nurseries)* as in other forests. Large snags are key structures used by flying squirrels and cavity-nesting birds. Fire consumes many logs, but many large snags are only partially consumed or entirely escape burning due to variation in burn intensity.

Key Results (cont)

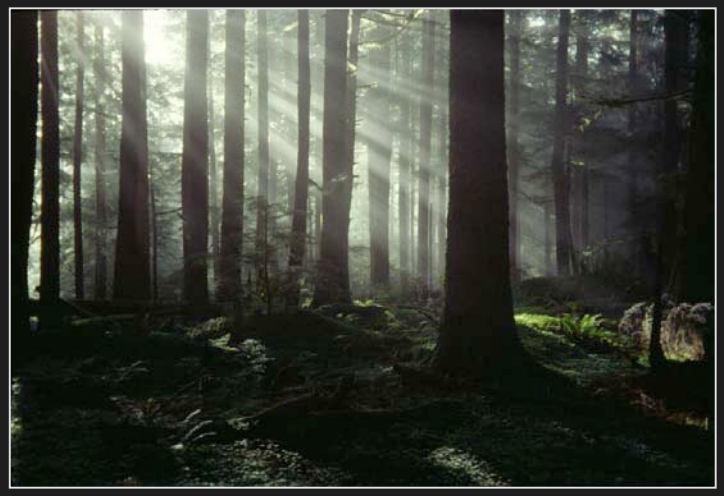
4) How does thinning affect fire intensity and extent?

Off-season *(outside July-Sept)* prescribed fire may have limited effect without thinning slash. In unthinned plots, the prescribed fire did not carry, and where it did burn there was little consumption. Thinning increased fire intensity, but the extent was patchy in places of concentrated skid trails.

5) How does thinning differ from fire in its effect on ecosystem function and succession?

Prescribed fire is most important for restoring ecosystem functions. Thinning alone, even when designed to mimic fire *(i.e., understory harvest with no burn)*, appears to stall some processes such as nutrient cycling, plant succession, and decomposition and respiration. Thinning intensity affects burning. Moderate thinning may beneficially increase off-season fire intensity. Overstory thinning, like a crown fire, has the potential to significantly change microclimate and forest structure, altering habitat and ecosystems processes outside the range of historic variability.

Looking Forward



- Forest health can only be restored if we have a measure for the effects of our management actions.
- Understanding how ecosystems function may be the best means of assessing our efforts.
- Thinning alone is not a substitute for fire restoration. Prescribed fire is always needed.
- There is a role for thinning when: 1) stands have high fuel loads, particularly ladder fuels; or 2) when prescribed fire is applied off season.
- A thinning prescription for fuel reduction should be just that, designed first to reduce fuels *(litter, slash and ladder fuels)* and second for any board feet *(diameter limits)* needed to pay for the operation.
- We still have many questions about the long-term effects of thinning and fire on ecosystem restoration.

Contact Info & Credits

Malcolm North
Teakettle Experiment, Principal Investigator
Sierra Nevada Research Center
Pacific Southwest Research Station
USDA Forest Service
2121 2nd Street, Suite A-101
Davis, CA 95616

Website: http://teakettle.ucdavis.edu

Prepared by Information Center for the Environment (ICE),
Department of Environmental Science and Policy,
University of California, Davis